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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE RO

REPLY TO: 3420 Evaluation DATE: July 22, 1987

SUBJECT: A Biological Evaluation of Portions of Snow Mountain, Hat Creek Ranger District, Lassen National Forest

TO: Forest Supervisor, Lassen National Forest

The enclosed report is Forest Pest Management's biological evaluation of Snow Mountain on the Hat Creek Ranger District. Observed pest damage on the red fir component of the stands was caused by a combination of red fir dwarf mistletoe and Cytospora canker. Damage from other pests was minimal. Pest management alternatives for consideration during treatment and a prognosis in relation to the urgency to treat the area are presented.

If you have any questions or concerns regarding this evaluation, please contact John Kliejunas (415-556-9083) of our Staff.

JOHN NEISESS
FPM Program Leader
State and Private Forestry

Enclosure

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FOREST PEST MANAGEMENT
Pacific Southwest Region

Report No. 87-10

3420 Evaluation
July 22, 1987

A BIOLOGICAL EVALUATION OF PORTIONS OF SNOW MOUNTAIN, HAT CREEK RANGER DISTRICT, LASSEN NATIONAL FOREST

John Kliejunas, Plant Pathologist

ABSTRACT

Red fir mortality and associated pest conditions on portions of Snow Mountain were evaluated to develop pest management alternatives for consideration during preparation of silvicultural prescriptions. The combination of red fir dwarf mistletoe and Cytospora canker was the pest complex responsible for observed damage. Management alternatives of no action, clearcut and regenerate, sanitation/salavage, and a combination of sanitation/salvage and clearcutting are discussed.

INTRODUCTION

On July 16, 1987, I accompanied Rich Coakley, acting District Silviculturist, Hat Creek Ranger District, to portions of Snow Mountain located above the proposed Snow Mountain Sale. The objectives of the evaluation were to confirm Rich's diagnosis of red fir dwarf mistletoe (Arceuthobium abietinum f. sp. magnificae) and Cytospora canker (Cytospora abietis) as the cause of branch flagging and mortality, to provide pest management alternatives for consideration during preparation of silvicultural prescriptions, and to provide a prognosis in relation to the urgency to treat the area to reduce pest impact.

OBSERVATIONS

The 100 to 200 acre area examined currently supports a high elevation (6500 feet) westside mixed conifer stand containing 60 to 80% true fir. Stand age ranges from 20 to 200 plus years. In addition to red and white fir, the area contains Jeffrey pine, lodgepole pine, and some sugar pine. Proportions of

species present varies from areas of pure red fir to areas of true fir mixed with scattered overstory pines. Site index varies from Dunning 4 to Dunning 5. The area is located above the proposed Snow Mountain Sale, a buy back sale currently being re-appraised.

Branch flagging of red fir was common throughout the area. Levels ranged from a few flagged branches on understory saplings and poles to flagging of three-fourths or more of the crown on numerous overstory trees. Red fir dwarf mistletoe and Cytospora canker were associated with the branch flagging. Dwarf mistletoe infection levels varied from moderate to heavy in both understory and overstory trees. Cytospora cankers were generally associated with dwarf mistletoe-infected branches, but cankers were also observed girdling and killing branches with no apparent dwarf mistletoe infection. Dwarf mistletoe was absent, and only very occasional branch flagging due to Cytospora was present, on white fir. Dwarf mistletoes were not observed on the pine species.

Fir engravers (Scolytis ventralis) did not appear to be particularly active. Top-killing and associated pitch flow were observed on only three overstory white fir throughout the area, and no attacks were evident on red fir. No evidence of annosus root disease centers, stem breakage or decay, white pine blister rust, or other pests were observed.

In summary, observations indicate that the combination of red fir dwarf mistletoe and Cytospora canker is the factor responsible for branch flagging and mortality of understory and overstory red fir. Some stress due to competition in overstocked aggregations of red fir may also be a contributing factor to the mortality.

MANAGEMENT ALTERNATIVES

1. No Action. If no action is taken, the health and vigor of the red fir component of the stands will continue to decline and further mortality will result. Additional red fir dwarf mistletoe infections will increase the amount of Cytospora canker present which will also drain tree and stand vigor. The dwarf mistletoe in the overstory will remain a source of infection for red fir regeneration in the understory, and the understory will suffer considerable growth loss as a result of the dwarf mistletoe and Cytospora canker. Consequently, mortality and top-kill from the fir engraver will increase. Other Scolytus species as well as the roundheaded fir borer (Tetropium abietis) will be associated with the mortality. However, the overstory red firs can be expected to dominate the site for several decades to come before they are replaced by understory species.

Total live stand volume should decrease as the overstory red firs die and the heavily infected understory trees are unable to sufficiently respond to maintain productivity over time. In other words, the younger red firs are likely to succumb to various mortality causes before they reach the size, age and abundance of the present overstory. They in turn will be the source of infections for any new reproduction. The cycle will go on indefinitely unless interrupted, and the manager will be unable to capture the potential productivity of the site.

2. Clearcut and Regenerate. Under this alternative, the overstory and understory would be removed and the site regenerated primarily to true fir. Complete removal of the overstory and destruction of the existing red fir understory would significantly decrease the chance of red fir dwarf mistletoe infection in the regenerated stands and greatly reduce the levels of Cytospora canker. Infection of the red fir in the new stands through spread of dwarf mistletoe from surrounding stands could be a chronic problem around edges of regeneration areas. Reinvasion should be considered when a regeneration block is being planned and efforts taken to minimize exposure of the new stand to adjacent infested stands of red fir. It would be advantageous to have clearcuts as large as practical and administratively feasible to reduce this edge effect. The boundaries of the regeneration units should be located wherever possible in uninfested or non-host type areas to prevent reinvasion of the area by dwarf mistletoe. This would be difficult. One way to avoid reinvasion from upslope sources of dwarf mistletoe would be to begin the clearcut blocks at the upper slopes of the mountain and then progressively move downslope. Planting only white fir and pines and avoiding red fir would eliminate the problem of outside sources of red fir dwarf mistletoe. Regeneration with pines would reduce the impact of dwarf mistletoe/Cytospora, but true fir may be desired or necessary to optimize timber yield. Jeffrey pine would likely suffer from snow damage and top breakage. Because white pine blister rust is present at lower elevations on Snow Mountain, only rust-resistant sugar pine should be considered for planting.

Clearcutting large areas would likely present regeneration problems. Brush currently existing on open areas of the stands include chinquapin and green leaf manzanita. These aggressive species would invade the openings created and would present severe competition problems without proper and effective control. Pocket gopher activity could present a problem. The need for control efforts would depend on management objectives, stocking levels, and gopher activity levels. Gopher activity, determined by mound surveys (See Animal Damage Control Handbook, FSH 2609.22), on 25 percent or more of the plots would indicate sufficient activity to adversely impact forest regeneration.

3. Sanitation/Salvage. This would remove the dead and dying red firs as well as those weakened by dwarf mistletoe and Cytospora canker infections. However, the extent of the dwarf mistletoe and Cytospora canker throughout the stands would make adequate sanitation impossible in areas of heavy concentrations of red fir without leaving portions of the stands severely understocked. Because a large proportion of natural red fir regeneration present is heavily infected with dwarf mistletoe, planting would be necessary. The sanitation/salvage operations would also likely cause considerable wounding of residual true fir trees and result in increased susceptibility to decay fungi and subsequent attack by the fir engraver. Although much of the dwarf mistletoe would be removed during the sanitation/salvage operation, infected leave trees would provide a source of inoculum for any red fir regeneration.

4. A Combination of Sanitation/Salvage and Clearcutting. Under this alternative, sanitation/salvage operations would remove heavily infected overstory and understory red fir from portions of the area with a significant component of white fir and pine species. Naturally occurring white fir and pine regeneration would be maintained. Areas containing pure red fir with

heavy mistletoe/Cytospora infections would be clearcut, infested regeneration destroyed, and the area planted to a mixture of true fir and some pine if desired.

This alternative would provide a future mixed conifer stand relatively free of the present dwarf mistletoe/Cytospora problem. Care should be taken during tree removal for residual true fir are often seriously affected by Cytospora because of logging injury and exposure shock. Wounding of leave trees would also increase their susceptibility to decay fungi.

DISCUSSION

Red fir dwarf mistletoe and Cytospora canker within the area examined were extensive, at moderate to severe levels, and causing some mortality and growth loss. The District is aware of the pest problems present and is considering three alternative time frames for treating the area. These are 1) putting in a special sale to treat the area immediately, 2) including the area in with the proposed Snow Mountain Sale, or 3) waiting until the Snow Mountain Sale is completed and then treating.

Putting in a special sale at this time does not appear warranted on the basis of additional expected pest impact alone. There appears to be no immediate danger that the pests will increase in intensity to epidemic levels to justify immediate silvicultural treatment. Dwarf mistletoe is a relatively slow moving disease and will not increase dramatically over the next decade or so. Both dwarf mistletoe and Cytospora have been working slowly in the stand for many years and will continue to do so. However, as stress factors such as moisture deficit and fir engraver activity increase, mortality would be expected to intensify. Regardless of current or potential pest impact, economic factors faced by the District would seem to preclude putting a sale in the area before the Snow Mountain Sale is completed. The combination of low timber volumes present, the need for cable logging in some portions, and the lack of adequate bridges or haul roads into the area would make for a deficit sale.

Attempting to include the area with the already proposed Snow Mountain Sale would be administratively difficult for several reasons. The Environmental Analysis would need to be ammended or revised, and the added volume would increase the Sale from the existing 26 million board feet to over 30 million, making it a Regional level sale. The current or expected pest impact in the near future does not seem sufficient to warrant an attempt to overcome these management considerations.

The most efficient alternative for treating the area from an economical standpoint would be to treat after the completion of the Snow Mountain Sale. The Snow Mountain Sale is located in a mostly old growth stand on Dunning Site 2. The volume harvested will pay for bridge and haul road construction up to the area we examined. Proposing a subsequent sale or series of sales in the area above and including some additional volume from the Snow Mountain Sale would pay for access road construction and required cable logging, making it a non-deficit sale. Although the pests are currently impacting the stands in the areas we examined, and levels of damage will slowly increase, treatment after completion of the Snow Mountain Sale (within ten years) rather than immediately will result in little difference in overall growth loss and mortality.

BIOLOGY OF PEST ORGANISMS

Red Fir Dwarf Mistletoe

Red fir dwarf mistletoe, Arceuthobium abietinum f. sp. magnificae, is a seed-bearing plant that parasitizes only red and noble fir. It will not survive without living host tissue, which it depends on for support, food, nutrients, and water.

Dwarf mistletoes initiate their life cycle when a seed lands on a needle or small twig of a host. The seed is coated with viscin, a sticky substance that allows it to adhere to the host tissue. During rains, the viscin becomes mucilaginous, allowing the seed to slide down to the needle base where it may lodge. The seed germinates in the winter or spring and the radicle grows along the twig until it reaches a needle base or bark irregularity. The radicle forms a holdfast and penetrates the twig into the xylem. A type of root system then develops in the twig. In 3 to 5 years from seed deposition, most successful infections will appear as branch swellings and will bear mistletoe shoots. These shoots will not produce fruit until at least 5 years following seed deposition, the average being 8-9 years. Fruit mature in the fall and disseminate seed in September and October. The seeds are explosively discharged from the fruit through the buildup of turgor pressure. Seeds normally have an upward trajectory.

Red fir dwarf mistletoe does not spread rapidly following establishment. Vertical spread in a tree averages less than 3 inches per year. Horizontal spread in a stand without overstory infection is also quite limited. The dense foliage of red fir limits spread because of the high probability of interception of the seed. Spread from infected overstory to understory may be up to about 100 feet, but it is usually less; the actual distance is dependent on slope, wind, and other factors. Trees less than 3 feet tall have a very limited chance of infection because of their small target size.

Infection of trees by dwarf mistletoe results in reduction of growth, growth abnormalities, mortality, and predisposition to other pests. Dwarf mistletoe swellings on true fir provide openings in the host bark for invasion by the canker-causing fungus Cytospora abietis, and a favorable environment for growth and development of the fungus.

Cytospora Canker

Cytospora abietis is a canker-causing fungus that infects true firs throughout their range in California. It is generally a weak parasite, and usually attacks trees that have been weakened or stressed by disease, drought, fire, insects, or human disturbance. It is most commonly associated with dwarf mistletoe infection, and sometimes attacks as many as a quarter of the mistletoe-bearing branches, killing many each year. The bright red flags of recently-killed branches on dwarf mistletoe-infected red firs are almost always the result of lethal Cytospora infections. Flags begin to appear in late spring and early summer. They are initially brick red, but turn light brown by autumn. Much of the dead foliage remains on flagged branches for at least a year and sometimes 2 to 3 years. Cytospora abietis occasionally reaches especially damaging proportions in certain years, and may attack trees of any age, sometimes killing the tops or all of young trees.

Fir Engraver

The fir engraver (Scolytus ventralis) attacks both white and red fir in California. Trees ranging in size from large saplings to overmature sawtimber are susceptible. Attacks can result in patch-killing of cambium along the bole, top-kill, or tree death. Top-kill or death occur most often in true firs that have been weakened by root disease, dwarf mistletoe, overstocking, soil compaction, sunscald, logging injury, or drought.

The fir engraver usually completes its life cycle in one year, sometimes two. Adults fly and bore into trees or green true fir slash from June to September; larvae, pupae, and adults over-winter under the bark. Pitch tubes are not formed as they are with pine bark beetles. The usual evidence of attack is boring dust in bark crevices along the trunk and pitch streamers on the mid and upper bole. Trees successfully colonized early in the summer may begin to fade by early fall, but those colonized later in the year usually do not fade until the following spring or summer, often after the beetles have emerged. Direct control of the fir engraver is usually impractical due to the widespread, sporadic occurrence of mortality, and the number of limited attacks that result in top and patch kill.